Assessing Access Constraints on System Equity: Source of Care Differences in the Distribution of Medical Services

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This article shows how differences in source of care can affect the likelihood that a person will obtain the medical services that he or she requires. Previous work has shown that the setting where care is received can have important effects on the quality of the services that are provided. The present study extends this line of research to questions of system equity. Unlike prior work in the area, the present approach emphasizes systemic relations among different types of delivery sites as a means of formulating and testing alternative models of service delivery. Preliminary findings indicate significant differences in utilization patterns depending on whether one establishes contact in a physician's private office. The results of the study suggest the need for continued concern over the role of access constraints in determining service opportunities.

Recent evidence indicates a trend toward greater equity in the distribution of medical care in this country [1,2,3,4]. For 1976, Aday et al. [5] report a 6 percent difference in the proportion of upper to lower income persons who saw a physician sometime during the year, as compared to a 15 percent disparity in 1963.[1] The corresponding difference between whites and nonwhites declined over the same period from 19 to 2 percent [5].[2] Similar changes have occurred along other dimensions of service use and among other social and demographic groups [2]. A number of explanations have been offered to account for these changes, but the general consensus seems to be one of real progress toward equalizing service opportunities. From a policy perspective, recent trends in service use reflect favorably on certain government programs designed to reduce

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access constraints [3], while giving pause to current proposals that would limit federal assistance in meeting service costs.

At the same time, there is growing concern over service inequities resulting from group differences in source of care (SOC). In the judgment of some writers, "the poor may still not participate in mainstream medicine, receiving care of comparable quality, convenience, and style to that received by more fortunate persons. Poor persons may continue to be treated in crowded and dreary clinics, enduring long waits and receiving few amenities. Care may be discontinuous, episodic, fragmented, and impersonal if patients see different physicians or health personnel at each visit" [2, p. 394]. Available survey evidence tends to support this image of a service system segmented along institutional lines. In the District of Columbia, for example, Dutton [6, p. 360] found that "use of *different health care systems* tended to be divided along economic lines. About three-quarters of the families at or below the poverty level reported either a hospital outpatient department or emergency room or a public clinic as their usual source of primary health care. . . . In contrast, most upper income families used traditional fee-for-service providers or the prepaid group practice" (emphasis added). Dutton's findings are supported by national estimates as well. According to Aday and Andersen [5; 7, p. 18] nonwhites and those below the poverty level are nearly twice as likely as whites and those above the poverty level to report a clinic as their regular source of care (32 percent vs. 17 percent in the case of nonwhites and whites, 28 percent vs. 16 percent in the case of those below and those above the poverty level).

While "it is hazardous to draw inferences about the quality and adequacy of care from these differences" in source of care, "it is fair to conclude that the poor (and other disadvantaged groups) do not receive the same kind of medical care received by most middle-income citizens" [2, pp. 398–399]. Again, Aday, et al. [5, p. 156] have found that people reporting outpatient departments or emergency rooms as their regular source of care are significantly more dissatisfied with the "humaneness of [the] doctors" they see than are those who report a private office as their regular source of care. There is also evidence of greater fragmentation in service settings of this kind, judging by the number of providers a patient sees during the course of an illness episode [8, p. 200].

Overall, then, available evidence suggests serious imbalances in the distribution of needed care, despite considerable progress in equalizing service opportunities within the population as a whole. There is also reason to believe that group differences in source of care are a major source of persisting inequities in service access and that further effort may be required to achieve established policy goals. While previous studies have served to highlight the basic dimensions of the problem, a more systematic approach is needed to determine where these imbalances are most likely to occur and which groups are likely to benefit from whatever corrective measures are undertaken. As a step in that direction, the following analysis develops a framework for assessing service inequities resulting from SOC differences in the distribution of medical care. Unlike prior work in the area, major emphasis is placed on systemic relations among service sites as a means of identifying group differences in service access. This approach is particularly well suited to the formulation of comparison groups for subsequent use in assessing how medical services are distributed. To judge by preliminary results from the present study, it can also be used to considerable advantage in formulating and assessing alternative models of service delivery.

Analysis and Results

DATA AND METHODS

Data for the analysis are taken from a national survey of health services utilization [1] and consist of a weighted sample of 56,820 individual-level observations. (The results reported below are adjusted to take account of the weighting factor used in the survey.) All respondents were asked whether they saw a physician during the survey year. Those reporting at least one visit were also asked to indicate where each visit occurred: (1) in the respondent's home (i.e., house calls); (2) in a physician's private office (including those located in clinics);[3] (3) in an outpatient clinic (regardless of whether the respondent was seen by a private physician or by salaried house staff); (4) in a hospital emergency room; or (5) in some other setting (including employee and student health facilities, board of health clinics, health maintenance organizations, and certain privately maintained union and fraternal clinics not connected with hospitals). Excluding pregnancy-related visits, roughly 65 percent (37,053/56,820 = .652) of all respondents reported at least one visit during the survey year. Of these, 89.3 percent (33,103/37,053) visited an office setting; 9.6 percent (3550/37,053) visited an outpatient clinic; 8.0 percent (2953/37,053) visited an emergency room; 3.2 percent (1197/37,053) were visited at home; and 5.9 percent (2191/37,053) visited other sites.

As a rough measure of user mobility within the system, Table 1 presents a percentage breakdown of those respondents who visited two or more settings. While almost three-quarters (73.6 percent) of the service

Table 1: Respondents Seeing a Physician by Service Site

Service Site	Sole Source Users	Multiple Source Users	Number
Home	34.0%	66.0%	1197
Emergency Room	19.1	80.9	2953
Outpatient Clinic	39.6	60.4	3550
Private Office	84.5	15.5	33103
Other	57.5	42.5	2191
Total (all sites)	73.6	26.5	37053

Source: 1970 Household Utilization Survey. Center for Health Administration Studies, University of Chicago.

population received all of its medical care at a single site, this rate varies markedly from one setting to the next. For example, more than eight of every ten (80.9 percent) emergency room users received additional services from at least one other source. By contrast, less than one in five (15.5 percent) office users visited another site. The remaining groups tend to straddle these two extremes, with house calls and outpatient visits generally conforming to the former pattern. While it is difficult to judge the broader significance of these patterns, it is clear that access to certain settings (as indicated by actual contact at a facility of that type) greatly affects one's need (or desire and perhaps ability) to seek additional services from other sources.

IDENTIFYING SERVICE BOUNDARIES

Table 2 provides a more detailed look at these service patterns. In all, there are 32 (2^5) possible combinations that can occur. To simplify the analysis, let A denote home settings; B, emergency rooms; C, outpatient clinics; D, private offices; and E, other settings. Likewise, let 1 denote the occurrence and 0 the nonoccurrence of physician contact in setting A, B, C, D or E. Then, utilization pattern (0,0,0,0,0) in Table 2 will refer to those respondents who did not see a physician at any time during the survey year; pattern (1,1,1,1,1) will refer to those who saw a physician in all five settings (in this case, no one), and so on for the remaining patterns in column one. The second column of Table 2 indicates the number of survey respondents reporting utilization pattern (i,j,k,l,m). Columns three and four contain numerical estimates of these frequencies derived under varying assumptions about the delivery process responsible for

Table 2: Cross-Classification of Physician Contacts by Service Site

*Utilization Pattern**					*Observed*	*Expected Frequency*	
A	*B*	*C*	*D*	*E*	*Frequency*	*Under H_0*	*Under H_1*
0	0	0	0	0	19767	19839.83	19708.39
1	0	0	0	0	407	426.95	372.54
0	1	0	0	0	565	1087.62	649.79
1	1	0	0	0	12	23.41	12.28
0	0	1	0	0	1405	1322.16	1472.68
1	0	1	0	0	13	28.45	27.84
0	1	1	0	0	123	72.48	48.55
1	1	1	0	0	1	1.56	0.92
0	0	0	1	0	27986	27691.44	27806.36
1	0	0	1	0	632	595.92	650.76
0	1	0	1	0	1814	1518.05	1975.69
1	1	0	1	0	65	32.67	46.24
0	0	1	1	0	1534	1845.40	1694.12
1	0	1	1	0	32	39.71	39.65
0	1	1	1	0	252	101.17	120.37
1	1	1	1	0	21	2.18	2.82
0	0	0	0	1	1260	795.71	1258.90
1	0	0	0	1	6	17.12	23.80
0	1	0	0	1	51	43.62	41.51
1	1	0	0	1	0	0.94	0.78
0	0	1	0	1	101	53.03	94.07
1	0	1	0	1	1	1.14	1.78
0	1	1	0	1	5	2.91	3.10
1	1	1	0	1	0	0.06	0.06
0	0	0	1	1	658	1110.62	659.56
1	0	0	1	1	6	23.90	15.44
0	1	0	1	1	41	60.88	46.86
1	1	0	1	1	0	1.31	1.10
0	0	1	1	1	58	74.01	40.18
1	0	1	1	1	1	1.59	0.94
0	1	1	1	1	3	4.06	2.86
1	1	1	1	1	0	0.09	0.07

Source: 1970 Household Utilization Survey. Center for Health Administration Studies, University of Chicago.
*Where: *A* = home; *B* = emergency room; *C* = outpatient clinic; *D* = office; and *E* = other.

distributing physician contacts. By comparing these estimates with the observed frequencies (f_{ijklm}) in column two, it is possible to determine whether access to a (set of) particular setting(s) affects the distribution of other service opportunities.

The Independence Model

The expected frequencies (F_{ijklm}) in column three of Table 2 indicate how physician contacts would be distributed if everyone were equally likely to visit setting A (and likewise for settings B, C, D, and E). We will refer to this assumption as the null hypothesis of perfect access (H_0 in Table 2), since it implies a system of service delivery which randomly allocates access opportunities within the population at large. Random utilization patterns imply the absence of access constraints resulting from factors other than simple differences in service capacity. Under these conditions, the probability (π_{ijklm}) of utilization pattern (i,j,k,l,m) will be

$$\pi_{ijklm} = \pi_i^A \, \pi_j^B \, \pi_k^C \, \pi_l^D \, \pi_m^E \tag{1}$$

where π_i^A is the probability of seeing (for $i = 1$) or not seeing (for $i = 0$) a physician at home, π_j^B is the probability of visiting (for $j = 1$) or not visiting (for $j = 0$) an emergency room, and so on for settings C (outpatient clinics), D (private offices) and E (other settings). The probability, then, of visiting, say, all five settings (π_{11111}), will equal the probability of a home visit (as given by the proportion of *all* respondents receiving a house call—or, 1197/56,820 = .0278), times the probabilities of an emergency room visit (2953/56,820 = .0520), an outpatient visit (3550/56,820 = .0625), an office visit (33,103/56,820 = .5826), and a visit in some other setting (2191/56,820 = .0386)—or, less than one in six thousand ($.0278 \times .0520 \times .0625 \times .5826 \times .0386 = 1.58 \times 10^{-6}$). The expected number of respondents with this utilization pattern (F_{11111}) will be 0.09 [$56,820 \times (1.58 \times 10^{-6})$].

The expected frequencies ($F_{ijklm}s$) for the remaining patterns appear in column three of Table 2. The overall "fit" of the model can be assessed using a goodness-of-fit Chi-square (GFX^2) statistic,

$$GFX^2 = \sum_{i=0}^{1} \sum_{j=0}^{1} \sum_{k=0}^{1} \sum_{l=0}^{1} \sum_{m=0}^{1} (f_{ijklm} - F_{ijklm})^2/F_{ijklm}\,, \tag{2}$$

or a likelihood-ratio Chi-square statistic,

$$LRX^2 = 2 \sum_{i=0}^{1} \sum_{j=0}^{1} \sum_{k=0}^{1} \sum_{l=0}^{1} \sum_{m=0}^{1} (f_{ijklm} \log (f_{ijklm})/F_{ijklm}), \tag{3}$$

where "log" in Equation (3) denotes the natural logarithm. GFX^2 = 281.91 and LRX^2 = 254.32 for the independence model, as compared with a tabulated Chi-square value of 37.65 at the .05 level.[4] Since a value as large as or larger than 37.65 would occur by chance in less than one sample in twenty, it is clear that access to certain (if not all) settings affects the likelihood of receiving care at (an)other site(s).

Access Constraints on User Mobility

There are several ways of modifying the independence model to take account of deviations from a state of perfect access. The expected frequencies in column four of Table 2 indicate how physician contacts would be distributed if access to a specific setting depended on systemic relations between that setting and other sites. In order to explain access differences in a delivery system of this kind, it is necessary to know the structure of those relations and the likelihood of making contact at specified service points. Following Goodman [9] and others [10,11], we will conceive of the contact variables in Table 1 as manifest indicators of this relational structure, and the structure itself, as a latent variable which determines the likelihood of physician contact at specific sites. It is possible to operationalize these notions by assuming that

$$\pi_{ijklm} = \sum_{t=1}^{T} \pi_{ijklmt}{}^{ABCDEX} \tag{4}$$

which expresses the idea that the observable proportions, π_{ijklm}, are the result of collapsing the classes of this latent variable, denoted here as variable X. By definition, variable X cannot be observed directly, but must be inferred from the relational structure linking variables A through E. This fact suggests the following criterion for assessing the structural properties of variable X: namely, that the associations among those variables disappear upon controlling for the level or class of variable X[5]. If the structural properties of variable X have been correctly described, then the following relationship will hold:

$$\pi^{ABCDEX}_{ijklmt} = \pi^{X}{}_{t} \quad \pi^{\bar{A}X}{}_{it} \quad \pi^{\bar{B}X}{}_{jt} \quad \pi^{\bar{C}X}{}_{kt} \quad \pi^{\bar{D}X}{}_{lt} \quad \pi^{\bar{E}X}{}_{mt} \,, \tag{5}$$

where $\pi_t{}^X$ is the probability that a person chosen at random from the population will be in class t of variable X; $\pi_{it}{}^{\bar{A}X}$ is the conditional probability that someone in class t of X will receive (for i = 1) or not receive (for i = 0) a house call; $\pi_{jt}{}^{\bar{B}X}$ is the conditional probability of visiting (for j = 1) or not visiting (for j = 0) an emergency room; and so on for the conditional probabilities of an outpatient visit ($\pi_{kt}{}^{\bar{C}X}$), an office visit ($\pi_{lt}{}^{\bar{D}X}$), and a visit at some other site ($\pi_{mt}{}^{\bar{E}X}$).

When T = 1, Equation (4) will reduce to Equation (1). In this respect, the hypothesis of perfect access can be viewed as a special type of latent structure model consisting of a single class of potential service users. To extend the analogy, a two-class model (T = 2) would indicate a bifurcated delivery system consisting of two distinct service populations. In general, then, the T classes of variable X represent different groups of service users, in much the same way that income, say, confers a unique market status on different economic groups. The model in Equation (4) also implies that variables A through E are mutually independent within each class of X, and it is in this sense that variable X can be said to explain the relational structure linking different service sites. It follows that physician contacts are randomly distributed within service classes and that variable X is the sole determinant of system access within that class of determinants involving systemic relations among (the five designated types of) delivery sites. In relation to our previous results, the model in Equation (4) expresses deviations from a state of perfect system access in terms of service boundaries which govern movement from one type of setting to the next. Since these boundaries correspond to class divisions within the population, it is possible to describe a segmented service system in terms of the structural properties of variable X.

Table 3: Latent Structure Parameters for Model H_1 in Table 2

		*Conditional Probabilities of Physician Contact**				
Latent Class	*Latent Class Probability*	*Setting A*	*Setting B*	*Setting C*	*Setting D*	*Setting E*
1	.583	.023	.066	.057	1.000	.023
2	.417	.019	.030	.070	0.000	.060

*Where: Setting A = home; B = emergency room; C = outpatient clinic; D = office; and E = other.

Table 3 presents the parameter estimates for Equation (4) assuming a two-class (or bifurcated) system of service delivery.[6] To aid in interpreting the other parameters, we turn first to the conditional probabilities of an office visit, where $\pi_{11}^{\bar{D}X} = 1.00$ for those in class 1 of variable X and $\pi_{1\bar{1}}^{\bar{D}X} = 0.00$ for those in class 2 of X. These estimates reveal that the service populations of private offices are comprised exclusively of individuals in the first user class. They also reveal that everyone in class 1 and no one in class 2 visits an office setting. In this respect, access to a private office is a "perfect" indicator of variable X, since class membership in variable X is synonymous with visiting an office setting.[7] It also follows that access to a private office is a perfect indicator of system access in general, since, by definition, variable X determines the likelihood of visiting (or not visiting) every service point in the system. Because of this unique relationship between variables D and X, it is possible to express the probability of utilization pattern (i,j,k,l,m) in the following way:

$$\pi_{ijklm} = \pi_1^D \quad \pi_{i1}^{\bar{A}D} \quad \pi_{j1}^{\bar{B}D} \quad \pi_{k1}^{\bar{C}D} \quad \pi_{m1}^{\bar{E}D} \quad , \tag{6}$$

where $\pi_1{}^D$ is the probability of an office visit, and $\pi_{i1}{}^{\bar{A}D}$, $\pi_{j1}{}^{\bar{B}D}$, $\pi_{k1}{}^{\bar{C}D}$, and $\pi_{m1}{}^{\bar{E}D}$ are the conditional probabilities that someone who makes (for $l = 1$) or does not make (for $l = 2$) an office visit will or will not contact a physician at home, in an emergency room, at an outpatient clinic or in some other type of setting. The probability, then, of visiting, say, all five service sites will be

$$\begin{aligned} \pi_{11111} &= \pi_1^D \quad \pi_{11}^{\bar{A}D} \quad \pi_{11}^{\bar{B}D} \quad \pi_{11}^{\bar{C}D} \quad \pi_{11}^{\bar{E}D} \\ &= (.582)(.023)(.071)(.057)(.023) = 1.23 \times 10^{-6}, \end{aligned}$$

and the expected number of respondents with this utilization pattern will be $(56{,}820)(1.23 \times 10^{-6}) = .07$. The expected frequencies for the other patterns appear in column four of Table 2. For model H_1 in Table 2, the $GFX^2 = 96.92$ and the $LRX^2 = 70.81$, as compared with a tabulated value of 33.92 at the .05 level.[8] A comparison of these values with those for the null hypothesis of perfect access indicates a [1.00 – (70.81/254.32)] 72.2 percent reduction in the variation unexplained by the independence model. So, while access to an office setting does not appear to be the sole determinant of system access in general, it clearly exercises a major influence on the distribution of medical care.[9]

To aid in interpreting these results, Table 4 contrasts the utilization patterns of persons who visited a private office with those who did not. The entries in column two indicate the probability that an office user or a nonoffice user will establish system contact. Those in columns three through six report the conditional probability that a service user from the first or the second group will contact a physician in a particular setting.[10] Overall, office users are nearly six (1.00/.167 = 5.988) times more likely to gain system access. The major reason for the disparity is the fact that office users visit at least one service site, while nonusers have a zero probability of establishing physician contact. Since the special relationship between variables X and D is responsible for these access differentials, it must be kept in mind that that relationship is an analytical result of structural patterns in the data and not a statistical artifact of the way that model H_1 was defined.

Of those who gain system access, nonoffice users are nearly five (.111/.023 = 4.826) times as likely to receive a house call, almost three (.179/.079 = 2.521) times as likely to visit an emergency room, nearly seven (.414/.061 = 6.787) times as likely to visit an outpatient clinic, and almost sixteen (.359/.023 = 15.609) times as likely to visit some other setting. The fact that this group is consistently more likely to visit every type of

Table 4: Expected Probabilities of Service Use Under Model H_1 in Table 2

Service Class	Probability of System Contact	Conditional Probability that a Service User will Contact a Physician at: Home	ER	Clinic	Other Setting
Office Users	1.000	.023	.071	.061	.023
Nonoffice Users	.167	.111	.179	.414	.359

nonoffice setting would seem to suggest that the service needs of nonoffice users are either greater (in relation to available services) or more specialized than those of office users. Both possibilities would explain the results obtained up to this point, but have quite different implications for the assessment of system equity.[11]

Specialized needs, for example, would require more specialized services which might explain why nonoffice users are more likely to visit emergency rooms and specialty clinics and why they do not seek such care in office settings. As for those who do not establish system contact in any setting, the implication is that they are fairly healthy as a group and, thus, do not require professional attention. Much the same could be said of the wide disparity in contact rates for "other settings," since this category is composed largely of service sources which either emphasize preventive care (such as vaccinations and routine examinations in the case of board of health clinics and health maintenance organizations) or are designed to handle fairly minor medical problems (as in the case of employee and student health clinics). In both cases, the broader implication is that all settings allocate service opportunities according to prevailing needs and that everyone has an equal (if less than ideal) chance of obtaining the care he or she requires.

On the other hand, the data could indicate distributional inequities favoring the service needs of office users. For example, nonoffice users may be more likely to contact other sites, not because their needs are more specialized, but because they are unable to locate (or retain) a private physician. Alternatively, they may visit additional settings because their needs receive less attention on the average and they are discouraged from returning to the same site. Moreover, observed disparities in nonoffice contacts may produce a false impression of actual differences in contact rates by ignoring the vast majority of this group which does not make system contact at all. In contrast to the previous scenario, the implication here is that at least certain nonusers are in need of care which they do not receive either because they are unaware of their needs or because the needed services are unavailable or have been denied them in the past. Whichever (combination of) factor(s) is ultimately responsible for these differences (unequal needs, access constraints, health beliefs, physician behavior, etc.), the net result is a delivery system that gives greater priority to the service needs of office users.

ASSESSING SYSTEM INEQUITIES

If "perceived need and evaluated need are the major determinants of health services use in an equitable system," then "a distribution of health services may be defined as more equitable, the stronger the *association* between utilization, perceived and evaluated need and demographic variables on the one hand, and the weaker the *association* between utilization and social structure, health beliefs, family resources and community resources on the other hand" [7, p. 10] (emphasis added).[12] When medical care is equitably allocated, these "associations" will be the same for all service groups, since system equity implies equal access for everyone who shares the same needs. By the same token, they will vary from one group to the next when nonoffice settings, say, accord greater priority to the service needs of office users. Table 5 presents the results of a multiple regression analysis designed to test these opposing views of why nonoffice users are more likely to visit nonoffice sites.

The estimates in the body of the table provide a percentage breakdown of the partial variance in physician contact attributable to various medical and nonmedical determinants of service use. With minor exceptions, the basic format corresponds to the one used by Andersen [7, pp. 16–17] in an earlier analysis of the same data.[13] As a baseline of comparison, the estimates in the second column of Table 5 indicate the relative role of medical needs (as presently measured) in determining system contact for the population as a whole.[14] Columns three and four present separate results for the two service groups identified in Table 3. The estimates in column three indicate the partial variance in physician contact at nonoffice settings due to differences in medical need among persons who also contacted a private physician. Those in column four indicate the corresponding breakdown for persons who did not visit an office site.

According to Andersen [7], health services are equitably distributed within the population when need factors account for more of the variation in system access than factors not directly related to a person's

Table 5: Percentage Breakdown of Explained Variance under Two Models of System Access

Predictor	Physician Contact in General	Contact at Nonoffice Sites by: Office Users	Contact at Nonoffice Sites by: Non-Office Users
Medical Need	11.5%	11.6%	5.8%
Demographic Factors	1.4	1.4	1.1
Age	.8	1.0	.4
Sex	.3	.1	.2
Marital Status	.3	.3	.5
Perceived Illness	10.1	10.2	4.7
Disability Days	7.7	7.0	3.9
Perceived Health	.5	.7	.1
Worry about Health	1.8	2.3	.6
Pain Frequency	.1	.2	.1
Enabling Factors—Family	7.3%	8.3%	9.8%
Family Income	.2	.4	.1
Insurance*	.5	.7	1.1
Regular Care†	6.6	7.2	8.6
Total Variance Explained	18.8%	19.9%	15.6%
"Need" as Percent of Total	61.2	58.3	37.2

Source: 1970 Household Utilization Survey. Center for Health Administration Studies, University of Chicago.

*Major medical coverage. This is health insurance which is designed to cover the heavy medical expenses resulting from a catastrophic or prolonged illness. It typically includes a deductible (e.g., $100), coinsurance (e.g., 20 percent) and a maximum payment (e.g., $25,000 to $100,000). Within these limits, it covers most out-of-hospital as well as in-hospital expenses associated with the particular illness.

†Regular source of care. This is defined in response to the question: "Is there a particular medical person or clinic [you] usually go to when sick or for advice about health?" "Regular Care" is a dichotomous variable distinguishing those answering "yes" or "no" to the question.

service needs (such as a person's ability to pay).[15] To judge by this criterion, the aggregate estimates in column two seem to support the popular view that access constraints no longer play a decisive role in the allocation of medical care. As shown by the bottom entry in that column, need factors account for well over half of the explained variance in system access for the population as a whole. But aggregate estimates can be deceptive, as shown by the group breakdowns in columns three and four.

For those who did not visit an office setting, need factors account for less than 40 percent of the explained variance in nonoffice contacts, as compared with nearly 60 percent in the case of office users. In other words, system access is largely a function of factors other than medical need for those persons whose only contact with a service provider occurs outside an office setting. Of the two groups of determinants, need factors are the major source of the disparity between those who visited an office setting and those who did not. Overall, need factors are twice (11.6/5.8 = 2.0) as important in the case of office users as they are in the case of those who did not visit a private physician. While additional work is needed to clarify the nature and sources of this disparity, it would appear that access constraints continue to play an important role in determining how medical care is distributed.

Conclusion

In this article, we have tried to show how differences in source of care can influence how medical services are distributed within the population. Recent trends in service use would suggest considerable progress toward equalizing access opportunities in this country. But aggregate estimates of system access may serve to conceal underlying disparities in service allocation. In this regard, the site(s) where a person establishes physician contact represents an important dimension of system access by determining if and where additional contact(s) will occur. In certain cases, group differences in source of care may reflect de facto service boundaries which effectively determine a person's chances of obtaining needed care. Throughout the analysis, we have refrained from drawing inferences about the quality and adequacy of the care provided in different settings. While it is clear that different groups tend to utilize different settings, additional work is needed to clarify the broader implications of those differences. For its part, the present study has served to show the importance of systemic relations among delivery sites as a means of operationalizing service boundaries and establishing a comparative baseline for more in-depth analyses of service distribution.

It has also served to illustrate a novel approach to formulating and assessing alternative models of service delivery. There are at least two ways that a service system can allocate needed services so as to meet conventional norms of system equity. One is to ensure that all persons sharing common needs also enjoy equal access to each type of setting. In the preceding analysis, this model was shown to imply the absence of structural ties among service sites. The fact that this model failed to describe actual patterns of physician contact points up the importance of such ties in structuring service functions within the system as a whole. Once again, no attempt was made to interpret this result apart from its immediate implications for system access.

Another way of ensuring service equity is to assign common functions to all delivery sites. Needed care will be equitably distributed in a system of this kind as long as those sharing common needs have an equal chance of visiting *some* site. In other words, it is irrelevant (from a strictly medical standpoint) where contact occurs if the care dispensed in each setting is truly comparable in all respects. Since an equitable system need not assure equal access to all service sites, the fact that some people visit private offices while others do not may simply reflect differences in provider preferences between the two groups. Even so, we would expect the service needs of each group to receive equal priority within the same setting. Thus, the fact that need factors play a greater role in determining nonoffice contacts by office users suggests potential inequities in the distribution of needed care. And while this finding does not rule out other interpretations of the data,[16] it does suggest the need for further investigation into the factors responsible for the apparent disparity in service access.

Each model of service delivery raises a number of organizational issues. In the case of the perfect access model, the major problem is one of reconciling the initial need to establish physician contact with the subsequent need to match institutional capabilities to specific service requirements. In the absence of structural ties among delivery sites, this matching function must be carried out by the user himself, with all of the attendant difficulties of coordinating the necessary treatment functions. The common function model serves to simplify these problems by lessening the need to visit additional service sites. But in so doing, it also creates a need to duplicate service functions, which can have adverse effects both on the costs of medical services and on the conditions under which they are provided. Thus, neither model represents an optimal means of organizing service functions, even though both would tend to ensure a state of system equity. This would seem to suggest the need for a more balanced approach that recognizes the existence of other system goals and selectively implements and disregards certain features of each model. It is hoped that the present study will help stimulate further dialogue along these lines.

NOTES

1. The upper income group refers to those families with a combined annual income of $7,000 or over in 1963 and $15,000 and over in 1976. Of the respondents in this group, 79 percent reported seeing a physician in 1976, as compared with 71 percent in 1963. The lower income group refers to those families with a combined annual income under $4,000 in 1963 and under $8000 in 1976. Of these individuals, 73 percent saw a physician in 1976, as compared with 56 percent in 1963.
2. The contact rate for whites was 68 percent in 1963 and 76 percent in 1976. For nonwhites, the corresponding rates were 49 percent in 1963 and 74 percent in 1976.
3. This category also includes visits to group practice physicians when these were designated as office visits by the respondent.
4. There are five parameters to be estimated under the independence model (one for each marginal probability), so there will be $2^5 - 1 - 5 = 26$ degrees of freedom for testing the null hypothesis of perfect access. The critical value, 37.65, is obtained from the tabulated Chi-square distribution, a copy of which is available in almost any standard statistical text.
5. The rationale for this criterion is the same as the one used to describe a "spurious" correlation among two variables that "appear" to be associated because of a shared relationship with some other variable(s).
6. Special procedures are generally needed to estimate these parameters. In the present study, we have employed a computer program (MLLSA) written by Clogg [10] which produces maximum likelihood estimates using the iterative scaling algorithm suggested by Goodman [9]. It is important to note in this regard that the method of maximum likelihood provides "best-fitting" estimates in the sense that these estimates maximize the likelihood of obtaining the set of observed frequencies in Table 2 under a two-class unrestricted model.
7. It should be noted that this finding is an analytical result, and does not reflect any prior restrictions on the present model, apart from the fact that the model was constrained to have no more than two classes.
8. In general, there will be six more parameters under model H_1 than under H_0 (one more latent class probability and five more conditional probabilities pertaining to the second latent class). Strictly speaking, since $\pi_{11}{}^{DX} = 1.00$ and $\pi_{12}{}^{DX} = 0.00$, the large sample theory does not apply to the unrestricted model for the data in Table 2. As a result, H_1 must be considered as a restricted model for purposes of hypothesis testing, the restrictions in this case referring to the values of the two parameters in question. For the restricted model, there will be 22 degrees of freedom (two more than under the unrestricted model). See note 7 above and note 10 below so as not to confuse this technical correction with the analytical strategy originally used to obtain these parameter estimates.
9. This is as indicated by the reduction in Chi-square attributable to model H_1. Goodman [12] has suggested the following statistic as a measure of the explanatory power of a model: $R^2 = 1.00 - [LRX^2(H_1)/LRX^2(H_0)] = 1.00 - (70.81/254.32) = .72$. R^2 can vary between 0.00 and 1.00, so a value of .72

indicates a substantial improvement in explanatory power under model H_1. See Goodman [12] for a comparison of this statistic (R^2) with other measures of "variance explained."

10. These estimates were derived from those in Table 3 by noting the following relationships between variable X in Equation (4) and the likelihood of utilization pattern (0,0,0,0,0):

$$\pi^{ABCDEX}_{000001} = \pi^{\bar{A}\bar{B}\bar{C}\bar{D}\bar{E}X}_{000001} / \pi^{X}_{1} , \tag{7a}$$

$$\text{where } \pi^{ABCDEX}_{000001} = \pi^{X}_{1} \; \pi^{\bar{A}X}_{01} \; \pi^{\bar{B}X}_{01} \; \pi^{\bar{C}X}_{01} \; \pi^{\bar{D}X}_{01} \; \pi^{\bar{E}X}_{01}$$

$$\pi^{ABCDEX}_{000002} = \pi^{\bar{A}\bar{B}\bar{C}\bar{D}\bar{E}X}_{000002} / \pi^{X}_{2} , \tag{7b}$$

$$\text{where } \pi^{ABCDEX}_{000002} = \pi^{X}_{2} \; \pi^{\bar{A}X}_{02} \; \pi^{\bar{B}X}_{02} \; \pi^{\bar{C}X}_{02} \; \pi^{\bar{D}X}_{02} \; \pi^{\bar{E}X}_{02}$$

Equation (7a) expresses the conditional probability that an office user will display utilization pattern (0,0,0,0,0)—i.e., that someone in class 1 of X will not establish physician contact in any setting. Equation (7b) expresses the same notion for someone who made no office visits. For the first group, it is intuitively obvious that this probability will be 0.00, since, by definition, office users make physician contact in at least one setting. For the second group, the corresponding probability is

$$\begin{aligned} \pi^{ABCDEX}_{000002} &= \pi^{X}_{2} \; \pi^{\bar{A}X}_{02} \; \pi^{\bar{B}X}_{02} \; \pi^{\bar{C}X}_{02} \; \pi^{\bar{D}X}_{02} \; \pi^{\bar{E}X}_{02} / \pi^{X}_{2} \\ &= \pi^{\bar{A}X}_{02} \; \pi^{\bar{B}X}_{02} \; \pi^{\bar{C}X}_{02} \; \pi^{\bar{D}X}_{02} \; \pi^{\bar{E}X}_{02} \\ &= (1.00 - .02)(1.00 - .03)(1.00 - .07)(1.00 - 0.00)(1.00 - .06) \\ &= .83. \end{aligned}$$

Since one either does or does not establish physician contact, the probability of system access in general will be $1.00 - \pi_{000001}{}^{\bar{A}\bar{B}\bar{C}\bar{D}\bar{E}X} = 1.00 - 0.00 = 1.00$ for office users and $1.00 - \pi_{000002}{}^{\bar{A}\bar{B}\bar{C}\bar{D}\bar{E}X} = 1.00 - .83 = .17$ for those not visiting an office setting. The other estimates in Table 4 were derived in a similar manner using the definition of conditional probability. The derivation of these estimates reveals an important analytical result that may not otherwise be immediately apparent: namely, *all* nonusers are members of class 2 of X. While this result is intuitively obvious from the special relationship between variables X and D, it is important to stress that it need not have occurred. In other words, it is an analytical result reflecting structural patterns in the data, rather than a reflection of some prior restriction(s) imposed on model H_1. For related comments on this point, see footnotes 6 and 7 above.

11. Obviously, both possibilities could occur, in which case one would want to consider the relative importance of each. For present purposes, we shall proceed as if the two are mutually exclusive, in order to simplify the presentation and to underscore the basic points to be made.

12. At least one writer has taken exception to Andersen's definition of system

equity for its failure to clearly distinguish between the "magnitude" of the association between medical need and service use and the "causal direction" (positive or negative) of the relationship. For further details, see Chen [13]. While this distinction has important implications for the assessment of system equity, it goes beyond the basic problem of determining whether this association varies across different groups, and if so, whether one can identify where those variations are most likely to occur.

13. We have excluded one of Andersen's "need" variables, i.e., medical symptoms, which was not included in the data tape available for the present analysis. We have also omitted several "predisposing" and "enabling" factors which contributed negligibly to the explained variance in physician contact. Otherwise, the variables in Table 5 are the same as those used by Andersen [7].
14. In the case of a binary dependent variable (such as physician contact), ordinary least squares can be shown to produce unbiased estimates of the regression coefficients in the model. Among other problems, however, the error term in the model suffers from extreme levels of heteroscedasticity which makes it difficult (if not impossible) to formulate meaningful tests of statistical significance. For related problems and corrective procedures (which result in more efficient estimators), see Kmenta [14]. We do not take up these problems in the present paper, since our main interest is in comparing similar parametric structures rather than hypothesis testing in the strict sense of the term.
15. See note 12.
16. One possibility is that the service needs of those who visit nonoffice settings are greater in the case of office users than in the case of those who did not visit an office setting. In other words, the *relative* difference in need levels might be greater between office users who did and did not visit nonoffice settings than the *relative* difference in need levels between those in the nonoffice group who visited a nonoffice setting and those who made no visits at all.

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